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**MEASURING MIDWIVES' ACCURACY OF
ESTIMATING BLOOD LOSS**

BY

Christine Joy White

Degree Sought

Bachelor of Health Science (Nursing) Honours

School of Nursing

Western Australian College of Advanced Education

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Abstract

This study focused on the assessment of blood loss during childbirth by attending midwives. It is very important that the volume of blood loss during childbirth be reported with accuracy. However, it is traditionally accepted that the most commonly used method of estimating blood loss is inaccurate. This study attempted to determine the accuracy of the attending midwives' visual estimation of blood loss, during vaginal delivery, by measuring all blood loss with electronic weighing scales and comparing it to their visually estimated figures. One hundred and seven women, booked for confinement at a large metropolitan hospital, were selected for the study during their labour. Related samples *t* tests and Pearson's product moment correlation coefficients compared the actual measured blood loss, and the attending midwives' estimated blood loss. Significant differences were found, supporting the hypotheses at the 0.05 level of significance, that subjective visual estimation of blood loss during childbirth remains an inaccurate method. Both under and over estimation occurred regardless of the midwives' years of experience or education. The findings from this study imply that midwives should adopt more reliable methods of measuring blood loss. Furthermore, midwifery curricula should incorporate a component which prepares midwives for precise and accurate estimation of blood loss during childbirth.

Declaration

"I certify that this thesis does not incorporate, without acknowledgement, any material previously submitted for a degree or diploma in any institution of higher education and that, to the best of my knowledge and belief, it does not contain any material previously published or written by another person except where due reference is made in the text".

Signed:

A large black rectangular redaction box covers the signature. A horizontal line extends from the right side of the box.

Acknowledgements

The author wishes to thank her supervisor, Anne McMurray, for her guidance and advice during the course of this study; Amanda Blackmore for her assistance with the statistical analysis; and Keith Barton for his time and assistance.

Warmest thanks are extended to the delivery ward midwives for their willing co-operation. This study would not have been possible without them.

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Measuring Midwives' Accuracy of Estimating Blood Loss

Despite the universality of blood loss during childbirth, and considerable research undertaken by the medical profession, relatively little research has been conducted by midwives on the methods of determining blood loss. The medical profession have developed and researched 'precise' methods for measuring blood loss, using haemoglobin dilution techniques. Undoubtedly these methods are useful, particularly when they detect a large haemorrhage occurring within a short time after delivery. However, the more 'precise' methods for measuring blood loss are impracticable in the delivery room. Because of the time and effort required to make the measurements, and the fact that few patients exhibit symptoms of haemorrhage, these methods have not been adopted for routine use. Furthermore, there are no haematological tests which will measure the extent of the bleed in the acute phase at delivery. Immediate haemoglobin and haematocrit indicators fail to give an accurate estimate of blood loss because a number of hours elapse before there is a significant drop in the haemoglobin and haematocrit levels (More, 1984). Therefore, although traditionally deemed as inaccurate, the time-honoured method of visually estimating blood loss continues to be used, and relied upon, by midwives and obstetricians in clinical practice. The specific problem which provided the

impetus for this study was that the methods currently used by midwives in assessing the amount of blood loss during childbirth may be inaccurate, and this inaccuracy may be jeopardizing the wellbeing of the mothers.

Background and Significance of the Problem.

In the clinical setting, where this study was undertaken, the most common methods used by midwives to determine blood loss are visual estimation and direct measurement of collected blood. It is of some concern that midwifery students have received very little formal instruction about the assessment of blood loss during childbirth, relying instead, on more experienced midwives for this information. As a result, inaccuracies in estimating blood loss may have been perpetuated, whilst other more accurate methods of determining the quantity of blood loss may have been overlooked.

Although the reported inaccuracies in the estimation of blood loss have remained largely unheeded, the significance of accurate blood loss assessment at delivery has long been recognized. If the amount of blood loss is underestimated, serious consequences may ensue, the ultimate being death. Excessive bleeding remains a significant factor in the causation of maternal mortality (Report on Health and Social Subjects, 1989). In the 1982 Report on Health and Social Subjects, the authors concluded the chapter on maternal death due

to haemorrhage with the following comment, "Too often has blood loss been underestimated, not reported early enough, or not properly investigated, diagnosed of managed. 'Too little, too late', seems too often to have been the fault in management" (p. 38).

Less catastrophic bleeding leads to anaemia, and may expose the patient to serious complications such as renal failure or pituitary necrosis. Postpartum anaemia delays recuperation, reduces resistance to infection and may predispose the patient to puerperal thrombosis (Wright, 1977).

The midwife, working in an obstetric unit, is often the first, and possibly the only, professional person present at a vaginal delivery. Therefore the ability to accurately determine blood loss is very important. Obstetricians need to rely on the midwives' quick and careful clinical evaluation to allow for the expedient and rational planning of resuscitation. Accurate assessment therefore, contributes to the midwives' goal of rendering safe, quality patient care.

Purpose of Study.

The purpose of this study was to determine the midwives' accuracy in estimating blood loss immediately following childbirth, accurate assessment of postpartum blood loss being a valuable indicator of the mothers' health status.

Definition of Terms.

1. Amniotic fluid -- the fluid which fills the amniotic sac, and in which the fetus floats.

2. Antepartum -- before giving birth to a child (parturition).

3. Antepartum haemorrhage -- bleeding from the genital tract any time after the viable pregnancy gestation of 20 weeks until the child is born.

4. Delivery -- completion of the birth process.

5. Midwife -- a registered nurse who has successfully completed the prescribed course of studies in midwifery and has acquired the requisite qualifications to be registered to practice midwifery.

6. Postpartum -- after giving birth to a child.

7. Postpartum haemorrhage -- excessive bleeding from the genital tract after the child is born and before the end of the puerperium. Excessive measured as 500 millilitres or more.

8. Puerperal thrombosis -- the formation of a clot in a blood vessel during the puerperium, a period of six to eight weeks following childbirth.

9. Vaginal delivery -- pertaining to the birth of a child through the vagina.

(da Cruz, 1969)

Hypotheses.

The research hypotheses tested in this study were:

1. There will be a significant difference between the actual weighed amount of blood loss during a vaginal birth and the attending midwives' visual estimation of blood loss during a vaginal birth.

2. There will be a threshold above which the margin of inaccuracy of the attending midwives' estimation of blood loss during childbirth will become consistently greater.

3. There will be a significant difference between how midwives first learnt to estimate and the degree to which they over- or under-estimate blood loss.

4. Midwives who have more years of experience as a nurse and as a midwife in delivery ward will have increased accuracy in estimating blood loss at delivery.

Objectives.

The main objectives of this investigation were:

1. To compare the two sets of scores obtained between the actual measured amount of blood loss at delivery, and the attending midwives' estimated amount of blood loss.

2. To study the relationship between post delivery blood loss and the difference between pre and post delivery haemoglobin readings (the most widely accepted estimate of blood loss), in order to compare actual

with estimated blood loss. A positive relationship would support the weighing method used by the investigator as a reliable and measurable method of determining blood loss.

3. To determine whether there was a threshold above which the attending midwives are consistently inaccurate in estimating blood loss during childbirth.

4. To investigate any correlation between educational preparation, experience and accuracy of estimating blood loss.

Review of the Literature

Descriptions of Blood Loss During Childbirth.

Midwifery texts published prior to 1970, revealed a paucity of information related to the assessment of blood loss during childbirth. The only enlightenment two authors provided on this subject was a statement that delivery is accompanied by the average loss of 120 to 300 millilitres of blood. They defined postpartum haemorrhage loss as 500 and 600 millilitres, or more, of blood loss (Myles, 1969; Llewellyn-Jones, 1969). Later literature described the subjective estimation of blood loss as heavy, moderate or scant, depending on the amount of saturation present (Bethea, 1979; Campbell & Smith, 1977). However, the distinction between these descriptions was not defined accurately in terms of the actual amount of blood in millilitres. Bethea's (1979) only guide for nurses estimating blood loss was to suggest they keep "an accurate record of the number of pads the mother saturates in a given length of time" (p. 246).

Inaccuracies in Estimation.

Several authors of more recent midwifery texts have attempted to redress the inadequacies of earlier literature, by highlighting the importance of assessing the actual quantity of blood lost during childbirth. However, they all admit to the difficulty and inaccuracy

of visually estimating blood loss (Marchese, Coughlin, & Adams, 1983; Miller & Callander, 1989; Sleep, 1989; Towler & Butler-Manuel, 1980). Beischer and Mackay (1976) surmised that blood loss is almost always underestimated, by at least one third to one half, at delivery because the blood soaked into drapes and pads may not be included in the total.

A search of the literature revealed only three nursing research studies, related to measuring blood loss, have been published during the past ten years (Clough & Higgins, 1981; Higgins, 1982; Levy & Moore, 1985). These studies focused on the problem of nurses' accuracy in visual estimation of blood loss. The sample sizes for these studies ranged from 16 to 42 nursing participants. Each study involved outdated whole blood for transfusion being poured, in pre-measured amounts, onto various types of pads or delivery drapes. These blood stained articles were exhibited on trolleys. The participants were asked to estimate the volume in both millilitres and in terms of being slight, moderate or heavy blood loss. The data from these studies indicated that the problem of estimating blood loss is two-fold. Not only were there considerable inaccuracies in the actual amounts of blood estimated, but there were also wide discrepancies reported in what was considered as heavy, moderate and slight losses. Contrary to the traditionally accepted view and Levy and Moore's (1985) findings, that blood loss tends to

be underestimated, Higgins (1982) found that 71 percent of the forty two nurses participating overestimated and 25 percent underestimated blood loss. The remaining four percent were exact. A heavy loss was considered to be anything from ten to 500 millilitres, a moderate loss ten to 150 millilitres, and a slight loss from one to 50 millilitres. In all three studies, neither the type of nursing education, nor the number of years experience in estimating blood loss appeared to have any relationship to how accurately the nurses estimated (Clough & Higgins, 1981; Higgins, 1982; Levy & Moore, 1985). Higgins (1982) suggests that with practice and feedback as to their accuracy, nurses could learn to estimate more precisely.

Methods of Calculating Blood Loss.

The inaccuracy of visually estimating blood loss at delivery has been noted in several medical research studies undertaken (Brant, 1967; Newton, Mosey, Egli, Gifford & Hull, 1961; Prendiville et al., 1988; Wallace, 1967). The sample sizes of these studies ranged from 100 to 580. Brant, however, extrapolated his results from only 57 participants. The aim of these investigations was to measure the amount of blood loss entrapped in blood stained drapes and towels, and compare the results with the recorded estimated blood losses. The authors used various haemoglobin dilution techniques and spectrophotometry in order to obtain

their results. These methods involved mixing the blood stained articles in a solution which converts haemoglobin to acid haematin or cyanmethemoglobin, which in turn can be measured in a colorimeter. However, some of the results were not obtainable for over three days. Their findings indicated that for small losses of up to 300 millilitres, the recorded estimated losses were either reasonably correct or overestimated. As the amount of bleeding increased, however, the estimated losses recorded were found to be underestimated.

Nelson, Ashford, Williamson and Amburn (1981) reviewed these haemoglobin dilution methods in their own study. They concluded that the time and effort required to make the precise measurements of blood loss made them complex and ill-suited for adoption as a routine practice in obstetrics. Instead, these authors proposed a procedure they believed was sufficiently accurate and simple to be adopted routinely in obstetric units (Nelson et al., 1981). The procedure involved collecting a specimen of venous blood from the patient on her admission to hospital, then calculating the amount of blood lost at delivery. This was achieved by collecting all the clotted and unclotted blood lost and measuring it, as well as weighing drapes to ascertain spilt blood loss. The obstetrician thus knew the maximal potential blood loss immediately after delivery. If this maximal figure was considered greater than 15 percent of the patient's estimated blood volume, further laboratory calculations

could be made using the venous blood collected at the time of admission. Although the work of these authors had limitations due to the small sample size of ten, it does suggest potential usefulness in practice.

The concept of the maximal potential blood loss is consistent with the statements made by several other authors suggesting direct methods of determining blood loss (Clough & Higgins, 1983; Darden, 1981; Newton et al., 1961; Rawle & Seeley, 1987; Shaw & Lewis, 1981). Commonly used direct methods described by these authors are; (a) gravimetric method, whereby items, such as drapes, sheets or sponges, which have absorbed blood, are weighed on a scale before and after use, and (b) suction, or catching the blood loss into a bowl and measuring its volume. The authors reported that, in clinical practice, provided there is careful attention to detail, blood loss can be determined with reasonable accuracy using direct methods. Although Quinlivan and Brock (1970) used a haemoglobin dilution method in their study, they stated that the direct methods of measuring and weighing were the alternative choices of determining blood loss.

Difficulties and errors in measuring blood loss, using direct methods, include; failure to collect all the blood, and stained linen; incomplete weighing of all the linen; failure to weigh immediately before evaporation of the blood occurs; failure to account for

contamination of the blood with amniotic fluid and urine; failure to remove blood from the maternal surface of the placenta; and ignoring maternal blood still within the interstices of the placenta.

Discrepancies exist in the literature concerning the average maternal blood content within the placenta. de Leeuw, Lowenstein, Tucker, and Dayal (1968) found that their average of 59 millilitres was twice that of earlier studies, whereas Newton et al. (1961) indicated that from other studies they reviewed, this blood amounted to about nine percent of the placental weight.

An alternative indirect measure of blood loss used by researchers is the haemoglobin level of mothers (Brant, 1966; Moir & Wallace, 1967; Prendiville et al., 1988; Watson, 1990). This method has the advantage of being measured and can be regarded as both accurate and objective (Watson, 1990). Prendiville et al. (1988) stated, however, that the difference in haemoglobin levels before and after delivery are, in any individual case, unreliable. Nevertheless, the findings in their study did indicate a significant correlation between the difference in haemoglobin levels and net blood deficit, as measured by the haemoglobin dilution technique.

To summarize, this literature review raises interesting questions about the current assessment of blood loss at vaginal delivery. Many medical researchers, using 'precise' haemoglobin dilution methods of calculating blood loss, have used visual estimations as a comparison to their studies, and have demonstrated how inaccurate estimations can be. However, the assessment of blood loss during childbirth appears to be a much neglected area in nursing research and midwifery education generally. Therefore the two major questions raised are; (a) has blood loss assessment been adequately addressed by midwives and nurses? and (b) are the inadequacies described in the literature being addressed by nurse educators or inservice departments? There is no doubt that learning how to estimate blood loss accurately is very important, but midwives and nurses should also reconsider the methods used to determine its loss. A better knowledge of the problem can serve as a substantial basis for improvement in blood loss assessment by midwives.

Frame of Reference

The conceptual framework for this study was derived from the general systems theory, proposed by Ludwig von Bertalanffy in 1952, for organisational management. Von Bertalanffy's work contributed to the emphasis on a "systems" viewpoint which has been broadly used by other disciplines (Schermerhorn, 1986). Since 1970, nursing theorists, notably Rogers, King, Roy, Johnson and Neuman, have specifically used a systems theory approach in the development of their nursing models. These theorists propose a system's framework in which man is identified as the focus and concern of nursing (George, 1985).

A system is generally considered a collection of interrelated parts (input, throughput or transformation process, output and feedback), that function together as a whole to achieve a common purpose. An open system interacts with its environment and transforms human and material inputs into outputs. Feedback is central to an open system. Information about a system's performance provides a basis for the constructive action needed to maintain or improve the process (Schermerhorn, 1986).

Within the Health Care System many separate subsystems operate in interdependence with one another to create the desired outputs of good health care. This study focused on just one of those subsystems. The systems model described here is typically abstract and, as such, could not be directly tested by research

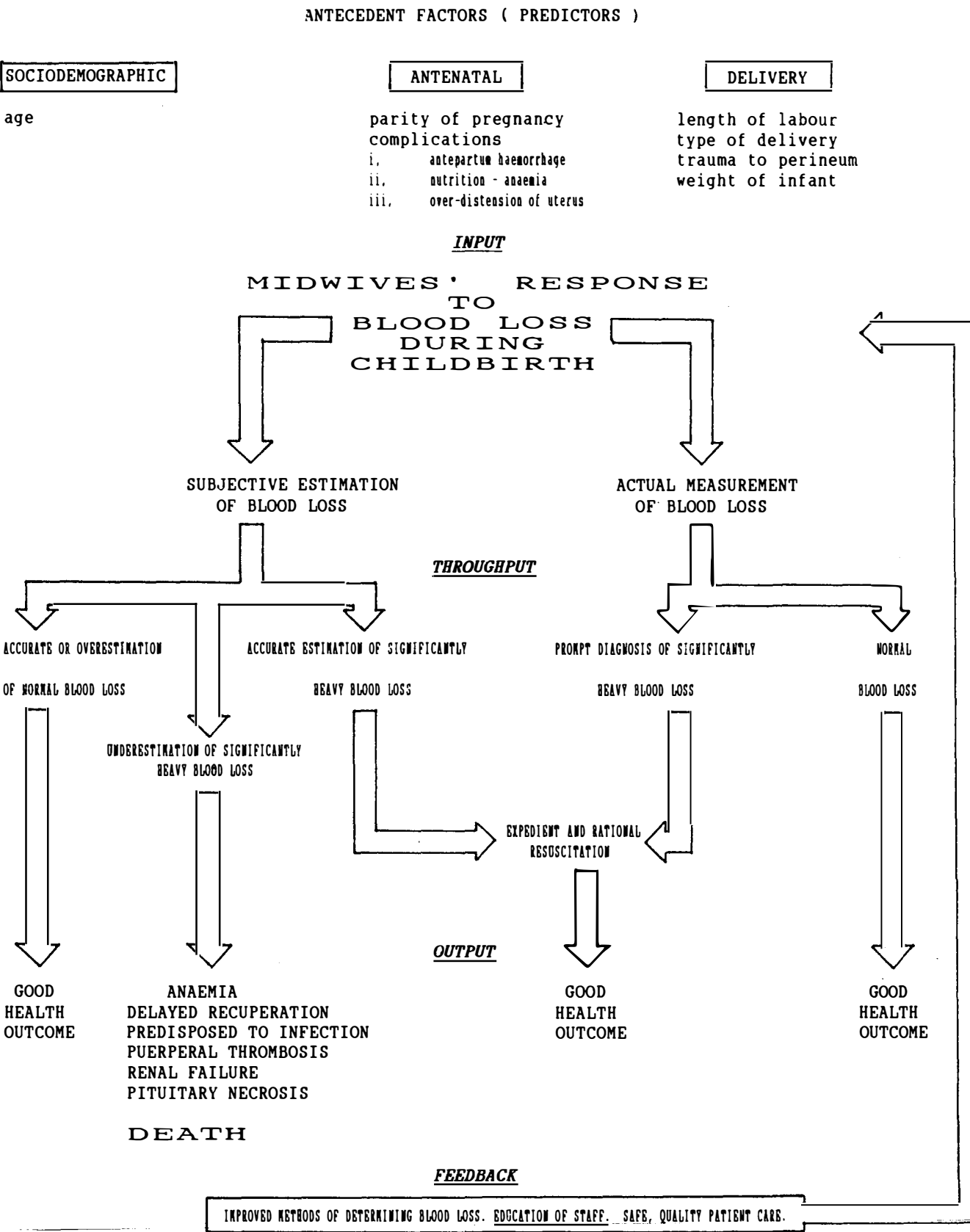
(Carveth, 1987). However, the model did serve to provide a structure and direction for this study, so that the assessment of blood loss could be better understood and explained.

Midwives' responses to blood loss during childbirth were viewed as an input into this open system. It was expected that the patients' likely outcome (output) resulting from blood loss during childbirth depended, not only upon the actual volume of blood lost, but also on the midwives' response and choice of method (throughput) for determining the magnitude of that loss. An inaccurate method (throughput) may expose the patient to serious complications or even death. The methods of assessing blood loss do not of themselves influence the amount of blood a patient loses, rather they reflect how the outcome may be influenced by the accuracy of the method chosen. A descriptive diagram of blood loss during childbirth, based on an open system, is given in Figure 1.

The diagram illustrates two methods of assessment of blood loss and the possible outcomes following the acute phase of blood loss during childbirth. When blood loss is accurately measured or estimated, the desirable outcomes are identified as good health. However, adverse outcomes can arise when a significantly heavy blood loss is underestimated. This is mainly because the problem is not recognized and appropriate treatment

Figure 1

Conceptual Model



THEORETICAL RATIONALE FOR MEASURING BLOOD LOSS DURING CHILDBIRTH UTILIZING AN OPEN SYSTEM.

The Open System is based on the General Systems Theory proposed by von Bertalanffy in 1952. Open Systems are open to the environment and consist of a collection of interrelated parts, (input, throughput or transformation process, output and feedback) functioning together as a whole to achieve a common purpose.

is not given immediately. The feedback loop highlights the importance of improving the methods of determining the volume of blood loss, and for staff education. In this sense, the model clearly anticipates midwives playing a preventive role. This will ensure safe, quality patient care.

Major Variables.

The three variables identified in this study were:

- (a) measured blood loss, by the investigator;
- (b) estimated blood loss, by the attending midwives; and
- (c) haemoglobin concentration levels in the blood.

Operational Definitions.

1. Blood loss -- the amount of blood in millilitres that is measured or visually estimated during childbirth.

2. Estimation -- a cognitive process whereby a midwife subjectively and visually assesses a specific amount of blood spilt on an item, such as a drape, during childbirth. This amount is recorded in millilitres.

3. Haemoglobin concentration -- an indirect, objective measurement of blood loss.

4. Weight -- the determination of the quantity of blood using electronic weighing scales, accurate to 0.1 gram in weight. Since 1 gram of blood equals 1 millilitre, the amount of blood loss is converted and recorded in millilitres.

. Assumption.

The major assumption upon which this study was based was that the blood loss estimates recorded by the midwives are a true reflection of what they believe is the actual loss.

Methodology

Research Design.

This research uses a quantitative approach to examine the difference between variables. By using ratio scale data this descriptive survey reports on what takes place in the clinical setting. This design was selected as the most appropriate because of the large sample number and in view of the study being non-intrusive. The main hypothesis tested concerned whether estimated blood loss and measured blood loss were significantly different from one another. Furthermore, the study sought to determine whether the actual blood loss corresponded to changes in the haemoglobin level tested pre delivery and two days post delivery.

Setting.

The setting for this study was the delivery suite in a 260 bed women's hospital in Perth, Western Australia, where approximately five thousand deliveries are conducted each year. The hospital is the major teaching and tertiary referral centre for the state. The investigator has 19 years midwifery experience, and is currently employed, by this hospital, as the Clinical Nurse Specialist in the delivery suite.

Population and Sample.

A non-probability, convenience sample of 121 participants was selected from the accessible population of pregnant women booked for confinement at this hospital. The participants were included in the study on the basis of their presentation to the delivery suite in labour whilst the investigator was on duty.

The following criteria were used for inclusion in the study. Participants will have experienced:

1. A vaginal birth.
2. No known antepartum complications that were likely to increase the risk of postpartum haemorrhage; for example, antepartum haemorrhage, hydramnious and multiple pregnancy.

Rationale for Criteria:

1. Midwives assume the responsibility for assessing the blood loss at all vaginal births, but not for caesarean births.
2. Antepartum haemorrhage is a complication manifested by bleeding from the genital tract prior to delivery. Hydramnious and multiple pregnancy -- because of the excessive amount of amniotic fluid present, there is unavoidable contamination of the blood at the time of delivery, making blood loss estimates more inaccurate.

Ethical Considerations.

Written approval for this study to proceed was given by the Western Australian College of Advanced Education Ethics Committee and the hospital involved (see Appendixes A and B for copies of the letters). Because the study involved no change of midwifery practice, or risk to the participants, the hospital's Nursing Executive decided not to solicit patient consent, on the basis that it may have caused unnecessary patient anxiety over potential excessive blood loss. However, out of respect for their privacy, the investigator did approach every potential participant, and her support person, early in the labour for permission to be present during the delivery. Each potential participants' attending midwife was simultaneously asked if she/he was willing to participate in the study. No-one refused this request. Their agreement to participate was accepted as formal consent. The collected data were coded to maintain anonymity and were available to the researcher only.

Data Collection Methods.

The data for this study were collected during an eight week period from July to August 1990.

To examine the difference between the two variables, measured blood loss and estimated blood loss, the investigator used electronic weighing scales to measure all blood loss following delivery. Two separate data

collection sheets were used in the study. The first was used to record the amounts of measured blood loss and the amounts of estimated blood loss made by the attending midwives. The participants' most recent antenatal and 48 hour postnatal haemoglobin results were also recorded on this data sheet (see Appendix C - data collection sheet 1).

Unless there is an indication to do so, postnatal haemoglobin tests are not routinely performed at this hospital. However, because of another research study currently being conducted, the investigator had access to postnatal haemoglobin results for 63 percent of the participants. The antenatal haemoglobin results were obtained from the participants' case notes. All haemoglobin levels were assayed using peripheral venous blood samples taken in to dipotassium EDTA tubes. The majority of the samples were taken antenatally between 35 and 40 weeks gestational age and 48 hours postpartum.

The second data collection sheet was used to record the attending midwives: (a) years of experience as a nurse; (b) years of experience in delivery ward; and (c) how they first learnt to estimate blood loss (see Appendix D - data collection sheet 2).

Reliability and Validity.

No pertinent research studies utilizing the weighing method were found, however, researchers have expressed confidence in the weighing technique, claiming that

provided the pre-weight of an article is known and weighing is carried out before evaporation of the fluid occurs, the weighing method will be accurate and reliable (Clough & Higgins, 1983; Darden, 1981; Rawle & Seeley, 1987; Shaw & Lewis, 1981).

The weighing method in this study was found to be consistent and precise and was therefore considered valid. Prior to the study commencing, measured amounts of water were added to pre-weighed absorbent items, then re-weighed. The difference between the dry and wet weights was found to be consistently correct. The electronic scales were also submitted to the manufacturing company for calibration. The scales were calibrated during and at the conclusion of the study to ensure no drift in accuracy occurred.

Procedure.

Prior to delivery, the investigator placed a sterile drape over the electronic scales. The scales were then zeroed with the drape in place, to exclude mathematical errors. The person delivering the baby, once gowned and gloved for the delivery, was asked to place the three sterile drapes, from the delivery pack, on the scales. The weight of the drapes was recorded on the first data collection sheet.

At the time of delivery, the attending midwife was given standardised instructions as follows:

1. Collect as much blood as possible into a kidney dish for direct measuring, using the weighing scales.
2. Visually estimate the remaining amount of blood spilt on the drapes (as they would do normally, regardless of the study). This estimated loss, in millilitres, was recorded on the first data collection sheet.

After the attending midwife had estimated the volume of blood loss, the investigator used the drapes to wipe up any further spills of blood, and blood from the attendant's gloves. The three drapes were re-weighed and the weight, in grams, recorded. The difference in the pre and post delivery weights was calculated and recorded as the volume of actual blood loss in millilitres. All extra pads that may be used during a delivery have a known standard weight, therefore it was not necessary to pre-weigh them. If they were used, they were weighed post delivery in the same manner as the drapes.

Surplus blood was removed from the maternal surface of the placenta and added to the collected blood in the kidney dish. This collected blood was poured into a plastic bag and weighed on the electronic scales. The weight was recorded on the first data collection sheet in millilitres. The volume of maternal blood still within the interstices of the placenta was calculated as nine percent of the placental weight and recorded on the data collection sheet.

Data relating to the midwives' years of experience

and blood loss estimation was recorded on the second data collection sheet following the delivery.

Methodological Limitation.

The extraneous variable that interfered with this study was contamination of the blood with amniotic fluid. In the situations where amniotic fluid could not be separated from the blood at the time of delivery, the participant was excluded from the study.

Results

Data Analysis Procedures.

Two methods of statistical analysis were applied to the data, using the Statistical Analysis System (SAS) statistical program. These were two-tailed, related samples t tests and Pearson product moment correlation coefficients.

The three dependent variables, measured blood loss, estimated blood loss and haemoglobin levels were all ratio level data, therefore it was reasonable to assume a normal distribution of data. The advantage of using the above parametric statistics was, as Munro (1986) explained, that they are more likely to find a significant difference if one existed. Significance was set at the 0.05 level for all tests.

Sample Description.

One hundred and twenty one participants were recruited to the study. Fourteen of these participants were subsequently withdrawn because of amniotic fluid contamination of the blood loss on the drapes during their deliveries.

Demographic data related to the participants (N = 107) revealed an age range from 15 to 41 years, with the mean age being 26.3 years. Sixty seven (63%) of the participants were married, 22 (20%) were single, and

18 (17%) lived in a defacto relationship. The three racial groups represented were Caucasian (86%), Asian (9%), and Aboriginal (5%).

Fifty-three midwives, working in the delivery ward, took part in the study. The midwives were almost homogeneous with regard to their educational preparation for both nursing and midwifery qualifications. Only one midwife had a tertiary based diploma in nursing, the remaining 52 were graduates of hospital based training courses. Table 1 presents the differences in percentages of years of experience both as a nurse and as a midwife in delivery ward. As Table 1 shows, the majority of the midwives (95%) had greater than five years experience as a nurse. However, this is in contrast to the 83 percent who had less than five years experience as a midwife in delivery ward.

Table 1

Percentages of Years of Experience

Years of Experience	<u>n</u>	%
As a Nurse		
0 - 2	0	0
2 - 5	3	5
5 - 10	21	40
10 - 15	17	32
> 15	12	23
As a Midwife		
0 - 2	29	55
2 - 5	15	28
5 - 10	2	4
10 - 15	4	8
> 15	3	5

Descriptive Statistics.

Before examining the results in detail, a comparison of the descriptive statistics of the sample was undertaken. Table 2 identifies the significant means and percentages of the blood loss, type of delivery and perineal integrity for the sample. These were obtained when the data were analysed with a scientific calculator.

Of significance were the mean total blood loss for the 107 participants and the excessive postpartum haemorrhage rate. As Table 2 shows, the mean blood loss at the 107 deliveries was 509 millilitres and the median was 341 millilitres. The distribution of scores was bimodal with 195 and 503 millilitres respectively. The postpartum haemorrhage rate was an overall 36 percent. When calculated for spontaneous deliveries only, the corrected rate was 28 percent. These figures take into account the maternal blood retained within the interstices of the placenta, which was estimated as nine percent of the placental weight.

It was beyond the scope of this study to conduct indepth analyses of the many factors, such as mode of delivery, episiotomy rate or parity, responsible for individual variations in blood loss. Although these statistics are irrelevant to the hypotheses being tested, they do serve to stress the significance of the study and may provide a basis for future research.

Table 2

Mean Values, Percentages and Ranges for the Various
Indices of Blood Loss and Outcome

Index	<u>n</u>	%	Mean (mls)	<u>SD</u>	Range
Total blood loss	107	100	509	436.34	34 - 2208
Total blood loss less than 500 mls	68	64	258	114.95	34 - 497
- overestimated	18	26	38	29.81	5 - 105
- underestimated	31	46	42	46.38	5 - 200
- exact	19	28			
Type of delivery					
- spontaneous	63	93			
- forceps	2	3			
- vacuum extraction	3	4			
Perineum					
- intact	33	49			
- 1° tear	11	16			
- 2° tear	7	10			
- episiotomy	17	25			
Total blood loss greater than 500 mls	39	36	948	443.60	503 - 2208
- overestimated	7	18	61	50.45	10 - 140
- underestimated	27	69	175	152.15	5 - 560
- exact	5	13			
Type of delivery					
- spontaneous	30	77			
- forceps	5	13			
- vacuum extraction	4	10			
Perineum					
- intact	9	23			
- 1° tear	19	49			
- 2° tear	6	15			
- episiotomy	5	13			

Data Related to Accuracy of Blood Loss Estimation.

Hypothesis 1. The first hypothesis of this study investigated the difference between the investigator's measured blood loss scores, using weight, and the attending midwives' visually estimated blood loss scores.

To compare the means of the two sets of scores and determine the accuracy of the attending midwives' visual estimation of blood loss, a two-tailed, related samples t test ($\alpha = 0.05$) was carried out ($N = 107$). The t test confirmed that there was a significant difference between the mean scores ($t = 4.83$, $p < 0.0001$, $df = 106$). This result indicated that the attending midwives' underestimated blood loss at the 107 deliveries by a mean 58 millilitres. The difference between the measured blood loss and the estimated blood loss ranged from -140 to 560 millilitres, with a standard deviation of 123.9.

Therefore Hypothesis 1 is supported because there is a significant difference between the mean scores of measured blood loss on the drapes and the attending midwives' estimated blood loss.

Hypothesis 2. The second hypothesis proposed that there will be a threshold above which the margin of inaccuracy, of the midwives' estimation of blood loss during childbirth, will become consistently greater.

By graphing the relationship between the actual total blood lost by the participants and the accuracy scores (actual measured blood loss minus the estimated blood loss), it was possible to establish that there is a threshold above which the attending midwives become consistently inaccurate in estimating blood loss (see Figure 2).

Figure 2 graphically depicts that with increasing blood loss, there is a decline in accuracy, with underestimates becoming higher. However, the curve does not increase smoothly. It displays a saltatory appearance. The reason for this concerns the number of observations at each point in Figure 2. Table 3, in Appendix E, shows the number of observations for each point on the curve. Very few participants had large actual blood losses. Therefore the points on the right of the curve are based on only one to four observations. If this study were carried out with a very large sample it would be expected that the ascending curve would be smooth.

The midwives were relatively inaccurate at all points, however, by visually scanning the graph, it is apparent that the threshold lies somewhere between 251 to 300 millilitres, after which there is an increased margin in accuracy scores with increasing blood loss. This finding supports Hypothesis 2, as there is a threshold, of 251 to 300 millilitres, above which the attending midwives become consistently inaccurate in

in estimating blood loss.

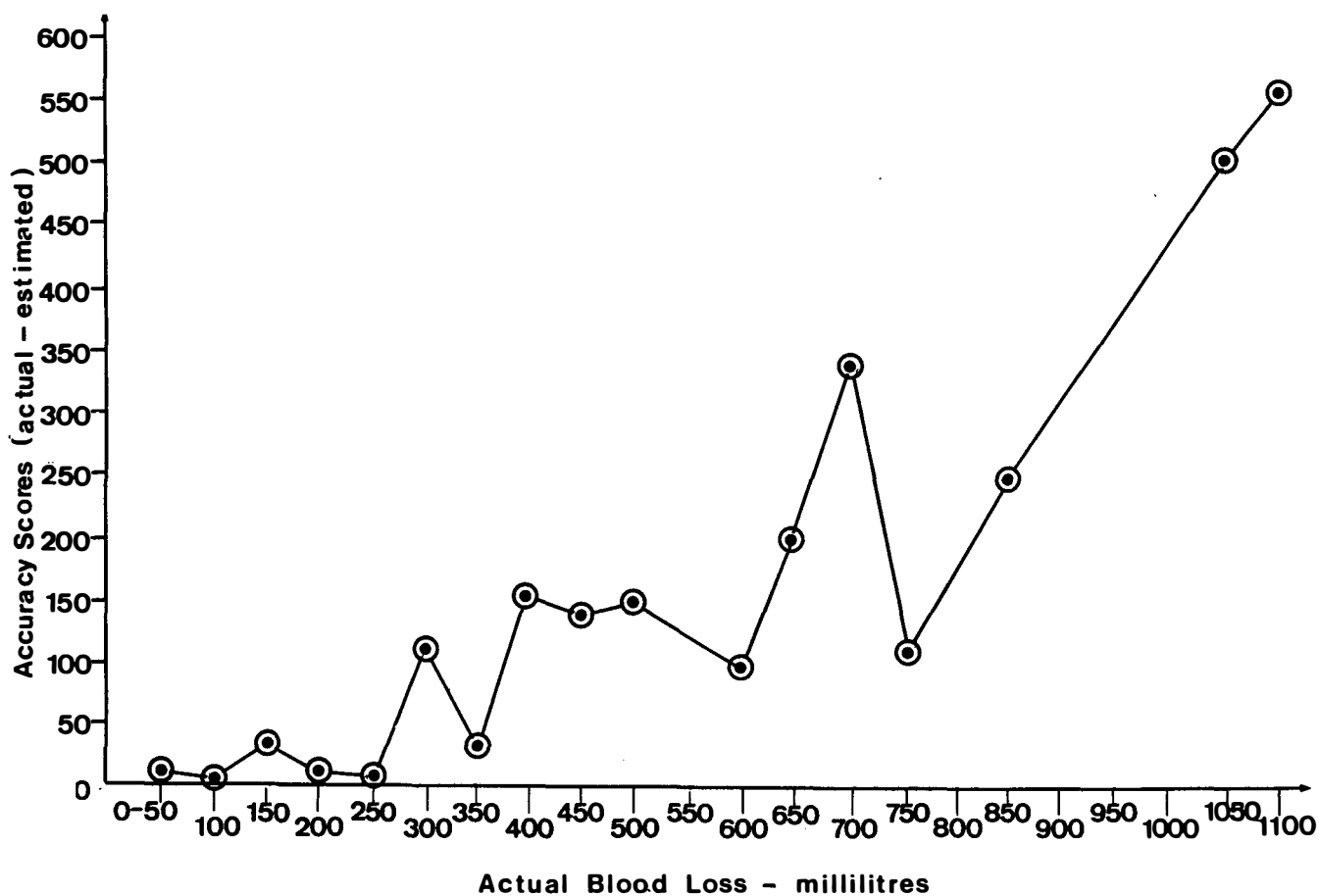


Figure 2. Relationship between actual blood loss and the accuracy of blood loss scores.

The initial t test revealed a mean difference of 58 millilitres of blood loss, which was discrepant with the expectations of the investigator. For this reason it was considered worthwhile to inquire further. Therefore the data for the participants were divided

into two groups according to whether 300 millilitres or less of blood loss was measured (\underline{n} = 68), or more than 300 millilitres of blood loss was measured on the drapes (\underline{n} = 39). Two-tailed, related samples t tests (α = 0.05) were computed for both groups separately to compare the group means and determine whether there were any significant differences between the measured blood losses and estimated blood losses for each group. When this was done, the significant difference for the '300 millilitres or less' group disappeared (\underline{t} = 1.45, p = <0.15 , \underline{df} = 67), lending further support to Hypothesis 2. However, Hypothesis 1 remained supported by the 'greater than 300 millilitres' group (\underline{t} = 5.68, p = <0.0001 , \underline{df} = 38). Table 4 shows the mean differences between the estimated and actual blood loss for the two groups.

Table 4

Means, Standard Deviations, t Values and Probabilities
For Under and Over 300 Millilitres Measured Blood Loss

Measured blood loss	\underline{n}	Mean	\underline{SD}	\underline{t}	p	\underline{df}
300 mls or less	68	10	56.78	1.45	<0.15	67
300 mls or more	39	144	158.13	5.68	<0.0001	38

The majority of midwives in this study tended to underestimate blood loss at delivery. Of the total blood loss estimations ($N = 107$), 58 (54%) estimations were underestimated, 25 (23.5%) were overestimated, and 24 (22.5%) were exact. Figure 3 gives the percentages of exact, over- and underestimations.

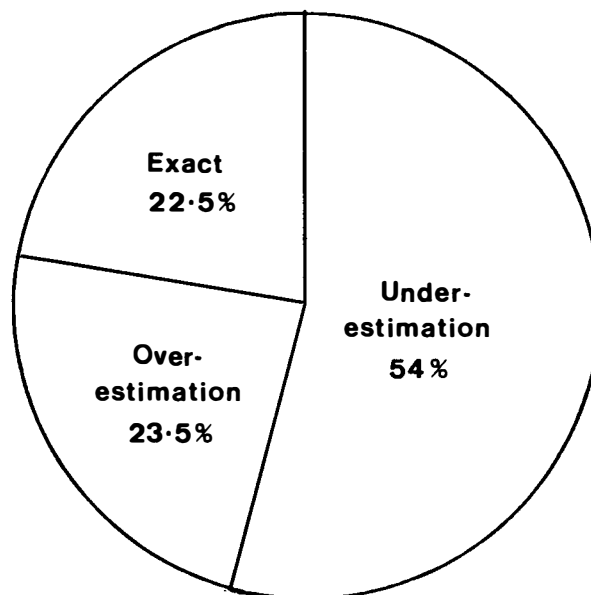


Figure 3. Percentages of exact, over- and underestimations of blood loss.

Data Related to Midwives' Experience.

Hypothesis 3. The blood loss at the 107 deliveries was estimated by 53 attending midwives. The midwives' responses to the question of how they first learnt to estimate blood loss fell into three categories:

(a) by guessing ($\underline{n} = 22$); (b) by teaching self ($\underline{n} = 24$);

and (c) by being taught to estimate, weigh or measure ($\underline{n} = 7$). 'Teaching self' differs from 'guessing' only by the midwives estimating the blood loss, then measuring or weighing the loss to provide themselves with immediate feedback as to the accuracy of their estimation.

For the purpose of this analysis, when a particular midwife estimated blood loss on more than one occasion, the first-time estimate she/he made was used.

A two-tailed, related samples t test ($\alpha = 0.05$) was carried out to determine whether there was any significant difference between how midwives first learnt to estimate and the degree to which they over- or under-estimated blood loss. The t test was used to compare the accuracy scores of the first two groups (guessing or teaching self). The third group, who was taught to estimate, weigh or measure, was excluded from the statistical analysis because of the small number. The means, standard deviations and maximum and minimum accuracy scores of the three groups are, however, given in Table 5.

The t test revealed that there was no significant difference between the first two groups ($\underline{t} = 0.46$, $\underline{p} = < 0.65$, $\underline{df} = 45$). This result suggests that there is no apparent improvement in accuracy of blood loss estimation when midwives attempt to validate their guesses by weighing the blood loss, thereby gaining immediate feedback on their accuracy. Therefore Hypothesis 3

is rejected.

Table 5

Means, Standard Deviations, Maximum and Minimum
Accuracy Scores of the Three Groups

	Group		
	1	2	3
	Guessing	Teaching self	Taught
Mean (mls)	85.7	71.3	5.7
S.D.	105.98	107.9	65.54
Max	480	505	85
Min	0	0	0
<u>n</u>	22	24	7

Hypothesis 4. This fourth research hypothesis stated that midwives who have more years of experience as a nurse and as a midwife in delivery ward will have increased accuracy in estimating blood loss at delivery. This hypothesis was tested by determination of Pearson product moment correlation coefficient ($\alpha = 0.05$). Actual years of experience, both as a nurse and as a midwife in delivery ward, were correlated with the midwife's accuracy score (actual blood loss minus the estimated loss).

Essentially no significant relationship existed between the midwives' nursing ($r = 0.25$, $p = < 0.07$) or

delivery ward experience ($r = 0.06$, $p = < 0.66$) and their ability to estimate blood loss more accurately. Therefore Hypothesis 4 was not supported.

The correlation between experience and blood loss estimates ($r = 0.25$, $p = < 0.07$) do, however, show a trend towards significance, suggesting that the length of experience as a nurse may improve midwives' accuracy in estimating blood loss.

Determination of the Significance of the Blood Loss.

Objective 2. The relationship between post delivery blood loss and the difference between the antepartum and postpartum haemoglobin levels was studied using Pearson product moment correlation coefficient ($\alpha = 0.05$).

The correlation undertaken between the measured total blood loss and the difference between the pre and post delivery haemoglobin levels revealed that there was a significant positive relationship between the two. However, this significance is not high ($r = 0.30$, $p = < 0.01$). Table 6 shows the mean pre and post delivery haemoglobin values and total blood loss ($n = 67$).

Table 6

Mean Pre and Post Delivery Haemoglobin (Hb) Values
and Total Blood Loss

Variable	N	Mean	<u>SD</u>	Sum	r
Total blood loss	67	565	505	37873	.01
Pre delivery Hb	67	11.3	1.20		
Post delivery Hb	67	10.9	1.28		

Discussion and Conclusions

The main purpose of the study was to determine the accuracy of the blood loss assessment methods, currently used by the attending midwives, in delivery ward.

This study has investigated the assessment of blood loss following childbirth within an open systems framework. The systems model clarified and interrelated the variables under study in a way in which they could explain the current situation in delivery ward. The findings from this study will have limited generalizability to clinical settings because gravimetric methods of determining blood loss are not always feasible. Although the findings cannot be generalized, they do suggest that the important implications that have emerged are worth the attention of midwives and midwifery educators.

The following discussion looks at the findings of this study in relation to the literature.

A number of conclusions are drawn from the study along with implications for midwifery practice and further research.

Descriptive Statistics: Mean Total Blood Loss and Postpartum Haemorrhage.

The statistics of greatest concern were the mean total blood loss and postpartum haemorrhage rate. The

mean blood loss in this study exceeded the maximum "normal" blood loss, and by the accepted definition is classified as excessive. Various researchers, using different techniques of accurately measuring blood loss at delivery, have reported findings similar to the findings of this study shown in Table 1 (Brant, 1967; Prendiville et al., 1988; Pritchard, Baldwin, Dickey & Wiggins, 1962; Ueland, 1976). Pritchard et al. (1962) and Ueland (1976) used radio-chromium labeled red blood cells and Iodine 131 tagged albumin, respectively, to determine blood volume loss at delivery. These studies indicate that women commonly lose considerably more blood during childbirth than has been generally appreciated. This makes the question of accuracy more vital.

The specific problem for this study was to determine the accuracy of the methods currently used by midwives to assess the amount of blood loss during childbirth. Later analyses look mainly at the midwives' accuracy of their estimation of blood loss. However, one cannot disregard the blood loss they collect and measure as well as estimate. The total blood loss normally recorded by the midwives at delivery is the sum of their estimated and measured blood losses. When the investigator subtracted the volume of blood, by which each midwife had underestimated, from the measured total blood loss it was encouraging to calculate that only five of the 107 deliveries would not have been identified as being greater than 500 millilitres. Because of the study the total measured blood losses for these

five participants ranged from 503 to 753 millilitres. However, had the study not been conducted the midwives would have recorded these five particular blood losses in volumes ranging from 307 to 445 millilitres.

Accuracy of Blood Loss Estimation.

The first hypothesis underlying this study was supported. A significant difference was found to exist between the measured blood loss and the estimated blood loss recorded by the attending midwives, indicating that visual estimation of blood loss is inaccurate and mainly underestimated. This finding is consistent with the research findings of other studies (Brant, 1967; Levy & Moore, 1985; Newton et al., 1961; Prendiville et al., 1988; Wallace, 1967). Even though the results showed a clear indication that midwives underestimated blood loss, it was unexpected to find such a low mean difference of 58 millilitres in the scores.

Studies conducted by Clough and Higgins (1981) and Higgins (1982) also found nurses to be inaccurate in estimating blood loss, although their findings were contrary to the findings in this study. The results from their studies indicated that 71 percent of nurses tended to overestimate blood loss. One possible explanation for this discrepancy may be related to the amount of blood the nurses in their studies were required to estimate. The largest quantity on any one particular pad was 80

millilitres. Although Levy and Moore's (1985) study methodology was similar to Clough and Higgins (1981) and Higgins (1982), their findings were congruent with this study's findings. Levy and Moore used drapes and pads on trolleys, with volumes of blood, ranging from 100 to 1200 millilitres, poured on the articles. Two hundred millilitres of normal saline were added to each amount of blood to simulate the presence of amniotic fluid.

The second hypothesis, which predicted that it would be possible to establish a threshold, above which the attending midwives became consistently inaccurate in estimating blood loss, was supported. The resultant graph depicted that the threshold of increased inaccuracy in this study was somewhere between 251 to 300 millilitres. This finding is congruent with the findings of Brant (1967). Brant found that for small blood losses the estimations were reasonably correct. However, when the blood loss recorded in his study exceeded 300 millilitres the estimations were invariably underestimated. Beyond the initial inaccuracy threshold, the findings from this study also matched those of Brant, in terms of the decline in accuracy with increasing blood loss. As the blood loss volume became greater in both studies, so too, did the amount of underestimation. The reason for this decline in accuracy is unclear. It was observed that when a small volume of blood was lost at delivery it was quickly absorbed by the drapes. However, when large volumes of blood were suddenly lost, the drapes could not absorb the

amount quickly enough before clotting commenced.

Therefore, what some estimators observed was, not so much the amount of blood and clots, but the total area of soakage on the drapes. In some cases, especially if there were several thicknesses in a folded drape, this total area was visually not much larger than the area which a lesser volume of blood would have covered. During general nursing training, trainee nurses are often taught to estimate clear fluid losses, such as urine on bed linen. It is believed they become quite accurate at this, but it may be argued that this is because the clear fluid continues to disperse until the initial pool is absorbed. In the case of fresh blood loss during delivery, it was observed that the initial pool clotted before the dispersion was completed.

It was interesting to note the reason why Higgins (1982) and Levy and Moore (1985) chose outdated blood for transfusion for their studies. Other than it being readily available and easy to use, it was chosen because it had some similarity to lochia, in that, like lochia, it had lost its normal clotting mechanism. This may be true for lochia but, as described above, it has not been observed to be the case for the blood lost immediately postpartum.

When the data for the participants, in this study, were divided into the '300 millilitres or less' group and the 'greater than 300 millilitres' group, the individual data analyses clarified both Hypotheses 1 and 2 and identified that the midwives do have difficulty estimating

large volumes of blood loss. But why? It may be questioned whether it is partly lack of cognitive skills or because, as student midwives, they are conditioned to believe what they are taught from midwifery texts. That is, that the average blood loss following a normal delivery is usually 100 to 300 millilitres (Myles, 1969; Llewellyn-Jones, 1969; Towler & Butler-Manuel, 1980). The inaccuracies may be perpetuated because of an expectancy effect which has resulted from their learning and from being mentored by role models whose estimates may also be inaccurate.

Midwives' Experience.

The findings related to Hypothesis 3 revealed that there was no significant difference between how midwives first learnt to estimate blood loss and their accuracy in estimating blood loss. Therefore Hypothesis 3 was rejected.

It may be considered then that regardless of how the midwives first learnt to estimate blood loss, they are alike in the way they estimate, with, as these findings indicate, a tendency to underestimate. These findings are consistent with the findings of Higgins (1982), except that the participants in her study tended to overestimate blood loss. The difficulty the midwives experienced possibly stems from the fact that the majority had not had any formal teaching with regard to determining blood loss. This suggests that at an early stage in the midwifery

curriculum careful attention needs to be focused on the assessment of blood loss.

The fourth hypothesis stated that midwives who have more years of experience as a nurse and as a midwife in delivery ward will have increased accuracy in estimating blood loss at delivery. It might be assumed that increased experience as a nurse and as a midwife in delivery ward would increase the midwives' accuracy in estimating blood loss. However, the findings from this study did not support this hypothesis and therefore it was rejected.

The finding that experience did not increase accuracy in estimating blood loss is congruent with other clinical studies (Clough & Higgins, 1981; Higgins, 1982; Levy & Moore, 1985). This lack of effect may occur because midwives receive little or no teaching or feedback as to how accurately they estimate.

It was encouraging to find that there was a trend towards significance of estimation accuracy with more years of experience as a nurse, because this suggests that experience could increase accuracy. Only three (5%) midwives had less than five years experience as a nurse, whereas 29 (55%) midwives had only two or less years experience as a midwife in delivery ward. It is conceivable that with feedback as to their accuracy, the number of years experience could effect the midwives'

ability to estimate blood loss more accurately.

Determination of the Significance of Blood Loss.

An objective of this study was to determine the relationship between postpartum blood loss and the difference between the antepartum and postpartum haemoglobin levels. This would substantiate that the investigator's method of weighing was a reliable method of measuring blood loss.

One hundred and one participants had their haemoglobin levels assayed. However, 19 had their haemoglobin tested antenatally only and 13 postpartum only. The remaining 67 participants had both antepartum and postpartum haemoglobin levels tested.

A significant positive relationship was found between the net blood deficit and the difference in haemoglobin levels ($n = 67$). Although the significance was not high, it was consistent with the findings of Prendiville et al. (1988) who obtained a similar correlation after using a haemoglobin dilution technique for measuring blood loss during childbirth. If, however, Watson's (1990) statement that haemoglobin levels can be regarded as accurate is correct, one would expect the correlation to be higher, if not perfect, as it demonstrates that the mean postpartum haemoglobin is lowered in relation to the mean blood loss during childbirth.

The finding from this study and that of Prendiville et al. (1988) is in contrast to the results Brant (1966) obtained. The difference in times when the haemoglobin concentrations were done could account for the major portion of this discrepancy. The haemoglobin levels in this study and that of Prendiville et al. (1988) were done 48 hours postpartum, the period when the haemoglobin concentration is expected to be at its greatest decline. Whereas Brant (1966) compared pre delivery haemoglobins with those taken on the third, sixth and ninth post delivery days. In their study, Pritchard et al. (1962) reported that by six to seven days after delivery the haematocrit and haemoglobin values had risen again and were almost identical to the average pre delivery values.

The mean decrease in the haemoglobin levels, shown in Table 3, compared well with the haemoglobin changes found by Begley (1990) and Prendiville et al. (1988) in their studies. This suggests that weighing the drapes at delivery, plus measuring the collected blood loss, is as accurate as the medical profession's 'precise' haemoglobin dilution techniques.

Implications for Midwifery Practice

The results of this study have implications for midwifery practice in the areas of:

1. Teaching - Learning. Teaching strategies should be aimed at increasing the ability of midwives to accurately estimate blood loss.

Midwives are responsible for assessing the amount of blood lost by patients, not only during all vaginal deliveries, but also throughout the antepartum, intrapartum and postpartum periods. Therefore as a profession, midwives need to be educationally prepared to become more effective estimators of blood loss. Teaching strategies need to be introduced early into the midwifery curriculum. An integral part of the ongoing learning process is experience, practice of the cognitive or estimating skills, and feedback as to their accuracy. The ability to estimate accurately is important, because it is not always feasible to weigh or measure blood loss.

2. Providing direction for improving the methods of determining blood loss; that is, methods that are measurable and reliable. Examples include a general adoption of gravimetric methods and the invention of an effective blood collection receptacle that would collect all the blood lost during childbirth. The kidney dishes currently in use are totally inadequate and

obstructive, purely because of their shape and size.

The midwives expressed positive attitudes toward this study and gave reason to believe they would become actively involved in adopting accurate methods of blood loss assessment. In fact, even after the research study was completed, many of the midwives continued to weigh their drapes, especially if the patient was at risk of postpartum haemorrhage. Other midwives asked the investigator for an average weight of the drapes after delivery because, after recognizing the patient had had a substantial blood loss, they wanted to measure the blood loss more accurately.

Directions for Future Research in Blood Loss Assessment

Based on the findings of the current study, it is recommended that future research should be directed toward:

- * Identifying the factors that facilitate or hinder a midwives ability to subjectively estimate blood loss.
- * Developing and evaluating the effectiveness of appropriate teaching strategies for estimating blood loss. This is necessary to provide a definitive response to the question: "How accurate are the current methods used by midwives in measuring the magnitude of blood loss immediately following childbirth".
- * Developing and evaluating appropriate methods of

measuring blood loss following childbirth.

- * Identifying the predisposing factors and possible changes in the management of labour, contributing to the apparent increase in postpartum haemorrhage rate.
- * Inventing and evaluating the effectiveness of a blood collection receptacle that can be used on a flat delivery bed.

The need for replication of this study is imperative if the accuracy of estimating blood loss is to be improved.

Summary

Precise estimations of the blood lost during childbirth are important because a large haemorrhage may occur in a short time. If the size of the haemorrhage is underestimated the patient may be exposed to serious complications, or even death.

The purpose of this study was to determine the midwives' accuracy of the most commonly used method of assessing blood loss at delivery - visual estimation. An open systems framework provided the structure and direction for this study. Fifty-three midwives, attending the 107 participant's deliveries, recorded their estimation of the blood loss soaked into the drapes. These estimations were compared with the investigator's more accurate, practicable method of weighing.

Data analyses revealed that midwives' visual estimations were inaccurate, particularly when the volume of blood loss was over 300 millilitres. Although exact, over- and underestimations occurred, 54 percent of the midwives underestimated. Furthermore, the years of experience of the midwives, or how they first learned to estimate, made no difference to their accuracy. The difference between the antenatal and postpartum haemoglobin levels showed a significant positive relationship with the total measured blood loss, indicating that the gravimetric method of weighing blood loss is a reliable and accurate method.

Midwives have a well established pivotal role in the assessment and management of women in labour. The assessment of blood loss is part of that role. The findings from this study provide the basis for the constructive action of the feedback loop, needed to improve the system of care. Midwives should adopt more reliable and measurable methods, such as gravimetric methods, to assess blood loss. It would, however, be short-sighted to suggest using only these methods, since gravimetric methods are not always feasible. Therefore midwives and midwifery educators should also include the teaching of blood loss estimation in both the midwifery curriculum and continuing education.



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SCHOOL OF NURSING

June 18, 1990

Ms Christine White
11 Munsie Ave
Daglish WA 6008

Dear Christine,

RE: Measuring the accuracy of Midwife's estimated blood loss.

A review of your proposal by the Western Australian College of Advanced Education, School of Nursing Ethics Committee has met with ethical approval.

I have enclosed some comments the reviewers made relating to your study.

On behalf of the committee, I wish you well with the implementation of your research.

Sincerely,

David Shorten
Chairperson,
School of Nursing Ethics Committee



KING EDWARD MEMORIAL HOSPITAL FOR WOMEN

10 July 1990

Ms Christine J White
11 Munsie Avenue
DAGLISH WA 6008

Dear Ms White

RE: MEASURING THE ACCURACY OF MIDWIVES' ESTIMATED BLOOD LOSS

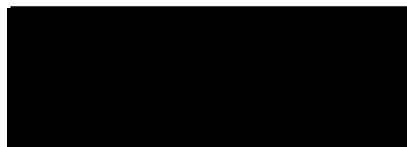
I am pleased to advise that the above Research Proposal has been approved and will be entered into the register of on-going research.

You are reminded of the following conditions:-

- . Progress reports may be requested
- . Any difficulties which threaten progress should be discussed with the Nursing Research Liaison Officer
- . It is your responsibility to inform the Nursing Research Liaison Officer when data collection is complete
- . At the conclusion of the study you must negotiate through the Director of Nursing for use of the Hospital name in research reports and conferences discussing the research.

The Nursing Executive extend their best wishes for your success in this project and look forward to receiving a copy of the report at the conclusion of the study.

Yours sincerely



PAT J MARTIN
DIRECTOR OF NURSING

DON\RESEARCH.DOC

Labour and Delivery Data

Birth Code Number _____

Age of mother _____

Parity of birth _____

Type of delivery:

Spontaneous _____

Forceps _____

Vacuum extraction _____

Perineum:

Intact _____

Episiotomy _____

1° tear _____

2° tear _____

3° tear _____

Length of labour:

1st stage _____

2nd stage _____

3rd stage _____

Weight of infant _____

Blood Loss Assessment Data

Post delivery weight of drapes _____ gms

Pre delivery weight of drapes _____ gms

= _____ gms = _____ mls

Blood on incontinent sheets and pads _____ mls

Total weighed blood loss _____ mls

Collected blood loss _____ gms = _____ mls

Estimated blood loss by midwife _____ mls

Placenta weight _____ gms. 9% = _____ mls

TOTAL blood loss = _____ mls

Haemoglobin: Antenatal _____ gm % Postnatal _____ gm %

MIDWIVES' EXPERIENCE AND LEARNING TO ESTIMATE

[illegible]

* Legend: 1 = guessing; 2 = teaching self; 3 = taught to est, weigh/measure

Table 3

Relationship Between Actual Blood Loss and the Accuracy of Estimations of Blood Loss: Means, Sums and Standard Deviations

Actual blood loss (mls)	Accuracy scores (mls)			
	<u>n</u> *	Mean	Sum	<u>SD</u>
0 - 50	16	8.8	140	22.77
51 - 100	20	4.3	85	35.55
101 - 150	13	31.9	415	75.40
151 - 200	8	10	80	88.84
201 - 250	6	2.5	15	68.25
251 - 300	5	111	555	68.77
301 - 350	12	27.5	330	84.25
351 - 400	5	153	765	79.58
401 - 450	2	140	280	35.36
451 - 500	2	150	300	70.71
501 - 550	3	129.3	388	154.72
551 - 600	2	95	190	134.35
601 - 650	4	205	820	136.74
651 - 700	3	338.3	1015	245.37
701 - 750	2	105	210	0
751 - 800	0	-	-	-
801 - 850	1	245	245	0
851 - 900	0	-	-	-
901 - 950	0	-	-	-
951 - 1000	0	-	-	-
1001 - 1050	1	505	505	0
1051 - 1100	1	560	560	0

* n = Number of estimates for each category.

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